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ABSTRACT

The effect of reading remediation that emphasized phonetic decoding was investigated in 61 children with pure reading disorders, controlling for the influence of nonspecific treatment effects. The children were randomly assigned to receive instruction in reading or in other subjects for four months; and they were reevaluated immediately after, two months after, and eight months after the cessation of the intervention. At the end of treatment, the children who had received reading remediation obtained significantly higher scores on all reading tests than did the control subjects. Some of the treatment advantages were maintained beyond the treatment period. The results clearly supported the efficacy of reading remediation that emphasized phonetic skills. (Author/RL)

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Children with Reading Disorders:

I. Efficacy of Reading Remediation

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Summary

The effect of reading remediation, which emphasized phonetic decoding, was investigated in children with pure reading disorders, controlling for the influence on non-specific treatment effects. Sixty-one children were randomly assigned to receive instruction in reading or in other subjects for four months. Children were reevaluated immediately after, and two and eight months after, the cessation of the intervention. At the end of treatment, the children who had received reading remediation obtained significantly higher scores than the controls on all reading tests. Some of the treatment advantages were maintained beyond the treatment period. Results clearly support the efficacy of reading remediation which emphasizes phonetic skills.

It is generally agreed that reading disorders are the most common form of learning disability; the latter, a procrustean concept encompassing a number of functional cognitive impairments.

The literature on children's learning and reading disorders has experienced a phenomenal expansion in recent years. Numerous articles have appeared on postulated cognitive deficits, on diagnosis, on early identification, and on the subtyping of various forms of learning disorders with the goal of providing methods for detecting children at risk and of enabling more rational remedial therapy.

Many approaches to the treatment of reading disorders have been proposed, such as gross motor exercises, fine-motor coordination training, various forms of motor-perceptual remediation, word recognition, and teaching of decoding and encoding skills. The empirical literature on the treatment of reading disorders has been reviewed recently (Gittelman, 1981). Strikingly, no teaching program has been shown to induce significant improvement in the reading ability of children with learning disorders. With regard to the use of reading instruction, a survey of the literature has failed to identify a single random assignment investigation of the differential effects of reading remediation vs. control treatments in children with reading disorders.

Only unsatisfactory studies of very small groups have been reported. Camp and Van Doorninck (1971) selected 14 children, two years below grade level, from a larger group randomly assigned to tutoring or no treatment. The 7 children who had been tutored were matched to 7 controls on initial status. No difference between the tutored and untutored children was found on the Wide Range Achievement tests of reading, spelling, or arithmetic. A significant advantage was found for the treated group on the reading of a vocabulary list--a task similar to that used in training.

Cashdan and Pumfrey (1973) studied the effects of tutoring done by university

specialists and by local remedial teachers in two groups of 12 children each. A group of 12 untreated controls was selected from clinic records. No difference in reading was obtained among the three groups. This study is limited by the fact that the two treated groups differed markedly in number of visits (37 vs. 14 visits, respectively), and no random assignment to all treatments occurred.

These two low power studies are of samples too small to permit whole-hearted acceptance of the null hypothesis; namely, that reading remediation does not significantly improve reading performance in children with reading lags. Thus, only very scant effort has been made to evaluate the merits of remedial tutoring.

Considerable attention has been given to the impact of positive reinforcement given in conjunction with reading instruction (Collette-Harris and Minke, 1978; Rybach and Staats, 1970; Schwartz, 1977; Staats et al., 1964; Staats and Butterfield, 1965; Staats et al., 1967). There are serious shortcomings in these reports since none provided a controlled evaluation of the effect of reinforcement on reading progress. The clinical reports claim that the addition of extrinsic, specific reinforcements (i.e., "motivated" tutoring) enhances reading performance (for a review of this work, see Lahey, 1976 and Gittelman, 1981). This effect, however, even if reliable, does not speak to any specific effectiveness for the remediation technique.

In view of the lack of evidence for the efficacy of reading instruction, the authors, between 1974 and 1979, conducted a study designed to investigate the efficacy of two interventions: 1. motivated reading remediation, and 2. methylphenidate in combination with motivated reading remediation. To permit firm conclusions regarding the impact of reading remediation, an untreated control group is not appropriate, since the advantage of tutored children could be due to the non-remedial aspects of treatment. The inclusion of children who receive equivalent attention, but no instruction, is crucial. Therefore, three groups were included: one received motivated reading remediation and placebo;

a second received an equivalent amount of attention as the first group, but no reading remediation or placebo; and the third received motivated reading remediation and methylphenidate. This paper presents the results obtained from the study of reading remediation; the study of the effects of methylphenidate is presented in another report (Gittelman, Klein, and Feingold).

This study addressed the following questions:

In non-retarded children with primary reading disorders, compared with attention controls, does an 18 week program of motivated reading remediation,

1) enhance the acquisition of basic reading skills?
2) enhance reading performance on
   a) individual tests of reading?
   b) self-administered tests?
3) affect performance on cognitive tests?
4) Are there behavioral changes associated with motivated reading remediation?
5) Does motivated reading remediation have long-term effects on basic reading skills and on reading performance?

The rationale for examining the effect of reading remediation on psychological test performance is related to the attention deficit theory of learning disorders, which posits that children with reading and other cognitive disorders suffer from poor attentional skills as measured by various cognitive tests. The evidence bearing on this point has been reviewed by Douglas and Peters (1980). Results are contradictory and pose interpretational problems. On the one hand, if children with learning disorders perform less well than normals on laboratory tests, it might be due to a disruption of basic cognitive processes which underlie various aspects of attention. If so, remediation would <u>not</u> be expected to have an impact on attentional task performance. On the other hand, it is conceivable that having experienced failure in mastering reading, children with reading disorders display

a generalized poor level of performance because of negative attitudinal factors. If so, improving reading skills might be expected to improve performance on measures of attention and other cognitive functions.

In a similar vein, improvement in attention in the classroom and during testing sessions might be detectable in children who had received reading instruction, since it is hoped that the instruction enables the child to obtain skills which facilitate his active participation in classroom tasks, thereby giving him a more positive attitude toward the likelihood of succeeding. If so, the child should show evidence of greater attentiveness in a variety of settings. To examine this possibility, the effect of reading remediation on behavior changes in the classroom, home, and during testing was assessed.

The hypothesized relationship between improvement in reading ability and improvement in test performance and behavior depends, of course, on the assumption that reading remediation is, in fact, instrumental in improving reading skills. If it were not, there would be little reason to anticipate secondary beneficial effects from the treatment. In spite of the absence of empirical evidence for the effectiveness of reading remediation, these other issues were investigated in this study since they required relatively little additional time and effort. It would be unrealistic to design a study especially for the purpose of investigating the concomitant effects of reading tutoring on behavior and psychometric performance, should it prove effective.

Methods

Subjects

To be considered for the study, children, between the ages of 7 and 13, had to come from English speaking homes and to be referred by teachers because of poor academic performance exclusively. They had to be reported to present no behavior problems in school. In addition, children had to be rated as not hyperactive, as defined by a mean score of less than 1.5 on the Hyperactivity factor of the Conners Teacher Rating Scale (Conners, 1969).

A Verbal IQ (VIQ) on the Wechsler Intelligence Test for Children--Revised (WISC-R) of at least 85 and a full scale IQ of 80 or more were required. Furthermore, Performance IQ (PIQ) had to be above 70. This last stipulation was adopted to avoid children with normal Verbal IQ's but with Performance IQ's in the retarded range (i.e., a child with a VIQ of 125 and a PIQ of 60, yielding a FSIQ of 92). A lower Performance IQ was allowed since it is believed to be less important than verbal IQ to the acquisition of language skills necessary to the development of reading. The degree of reading lag necessary for study entry was pegged to the child's IQ.

Children had to display reading lags (listed in Table 1) on the Wide Range Achievement Test (WRAT) (Jastak et al, 1965) and on the Gray Oral Reading Test (Gray, 1963). The WRAT is an untimed test of single word recognition, whereas the Gray Oral is timed and consists of oral reading of short story passages. Therefore, the Gray Oral taps the ability to use sentence context as well as word recognition. If a child met the reading criterion on the Gray Oral, but not on the WRAT, the child was given the Stanford Achievement Test (Madden et al, 1972). If reading scores on this test were above the stipulated level, the child was not accepted into the study. The rationale for using this third measure when a child met criteria on the Gray, but not on the WRAT, was due to the fact that the WRAT taps only word recognition; hence, a child might perform relatively well on this measure, while having deficient skills in other reading contexts, and would erroneously be considered as not having reading lags. This possibility seemed plausible in view of the fact that children had been referred by teachers as poor learners, and a test of contextual reading (the Gray) confirmed the teacher's judgments. The Stanford, a timed paper and pencil test, was felt to reflect classroom demands more closely than the WRAT and, as a result, was used to clarify confusing diagnostic situations.

The following exclusion criteria were stipulated:

No current significant psychopathology as evaluated through clinical assessments with the parents by social workers, and with the child by psychiatrists.

No diagnosable neurological disorders, such as cerebral palsy, epilepsy, microcephaly, etc. (The presence of neurological soft or isolated hard signs did not preclude entry into the study.)

No gross family pathology. Child had to be living with at least one parent in a stable home situation.

No uncorrected visual acuity defect of functional significance.

Informed consent was obtained from all parents. Since the overall study in-

cluded the administration of active medication or placebo, all parents were willing to have their child receive medication.

Experimental Treatments

This report includes results obtained it two groups: 1)"motivated" reading remediation, and 2) "motivated" non-specific academic tutoring as an attention control. Since the design included a third group receiving identical reading instruction in conjunction with methylphenidate, all the children in this study received a placebo.

1. Motivated Reading Remediation. The goal of the reading instruction was to improve basic reading performance, and to promote the concept that printed words represented language, or speech, on paper. To this end, the mastery of decoding skills was felt to be essential, and great emphasis was placed on teaching phonetic skills for decoding and encoding purposes. The treatment was individualized according to the child's reading ability, but in all cases the underlying philosophy of the remediation followed the principles of the phonics method. The Intersensory Reading Method devised by Pollack (Pollack, 1967a, b; Pollack and Atkins, 1971), which stresses phonetic training in the reading process, was used because it had been shown to be superior to a more traditional whole word approach in young normal children (Rubin and Pollack, 1969). It includes a kit of attractive, colorful objects, which serve to teach vowel and consonant sounds. The phonic readiness kit was used to build simple words with objects that represented letter sounds, such as a toy apple for the sound of the short "a". Afterwards, children proceeded to letter cards, and then to the reading of books (Pollack and Atkins, 1971; Pollack and Lane, 1969; 1971). In addition to phonic skills, reading comprehension, writing and spelling skills were taught. Other commercially available reading manuals were used when a child reached a reading level beyond that provided by the Pollack materials. These teaching materials, excluding those used in rare or isolated instances, are listed in Appendix A.

Whenever children were felt to have acquired the necessary phonetic decoding reading skills, whole word recognition was introduced to enable the development of smooth, efficient, rapid reading and to avoid overreliance on phonetic word analysis, which is a laborious, tedious process, highly atypical of the approach used by competent readers.

Children were also taught that there was a logical relationship between spoken and written language, and that a relationship with identifiable rules existed between speech and writing.

The remedial treatment did not rely on perceptual or perceptual-motor training techniques, which attempt to correct motor coordination, visual discrimination, or visual-motor performance. In all cases, children were taught reading per se, coupled with the reinforcement program described below.

2. Motivated Non-Specific Academic Tutoring. The purpose of this condition was to provide a control for the attention and reinforcement for learning given to children receiving reading remediation, to allow for an estimate of the effect of the teaching of reading above and beyond the non-specific aspects of treatment, such as the relationship between the tutor and child, the added parent-child contact necessitated by clinic visits, the teacher's knowledge that the child's problems were at last being attended to, the child's positive experience in a formal learning setting, etc.

At the same time, a play situation free of all instruction was felt to be unfeasible for control purposes, since the referred children had long histories of serious school failure, and since parents were making considerable sacrifices to attend the clinic. Therefore, we opted to provide the control group with tutoring in a variety of school subjects, such as mathematics, social sciences, or pure sciences, depending upon the child's current academic difficulties. To this end, the tutors used the child's school texts, as well as various commerical academic packages. A list of most of the teaching materials used in the non-reading

academic program is contained in Appendix B.

If, in the course of the academic tutoring, the child was unable to proceed because of a reading handicap, the tutors read the materials to the child, but never provided him with instruction on how to read. This teaching condition was also coupled with a reinforcement program.

For the sake of brevity, the group that received non-specific academic tutoring is referred to as the "attention control" group.

Extrinsic Reinforcement. Because of the clinical reports claiming that extrinsic rewards facilitate the acquisition of reading, all remediation was coupled with the reinforcement procedure described by Staats et al (1967).

Prior to the initiation of treatment, children were shown a large selection of attractive, popular toys which had a wide range of values expressed in a number of chips. It was explained to the child that he would be given chips and could exchange them at any time for one of the toys. Alternatively, the child could select something not in our inventory, a "price" was set on it, and it was purchased for him when he had earned the appropriate number of chips. The number of chips accumulated and the number yet to be earned were graphed at each session. Children were encouraged to select "inexpensive" items at the beginning of treatment so that they could experience tangible rewards early on in the treatment. Most did so; some, especially older children, preferred to hoard their chips for a grand prize.

Other Treatment Characteristics. Three professional reading teachers implemented the teaching program, performing both the reading and attention control procedures. Two were trained in the specific study methods and were supervised by the same individual, an expert in the phonetic reading instruction method; the third was the trainer (I.F.).

Tutoring was scheduled to overlap with the school year as much as possible, so that youngsters were attending school for the greater part of the study. Children were all seen individually at a clinic, three times a week over an 18 week period, for a total of 54 sessions. In addition to three appointments per week with a tutor,

children were seen weekly by a psychiatrist for the first four weeks, and about every other week or less thereafter to manage medication--a placebo in the two groups reported here--administered in double-blind fashion. Treatment was free of charge.

Assessments

A large number of evaluative procedures were obtained for diagnostic purposes, as well as for the assessments of treatment effects. These included tests of decoding skills (basic reading skills), several tests of reading competence, measures of academic proficiency in school subjects other than reading, and a battery of psychological tests aimed at assessing various aspects of cognition and psychomotor function. In addition, teachers, mothers, and the testing psychologist were asked to complete rating scales depicting a broad range of childhood behavioral characteristics.

Measures of Basic Reading and Auditory Skills. The following tests of basic decoding reading skills were used: the Pollack test of auditory discrimination and blending of phonemes, the Pollack test of basic reading skills (Pollack, 1969), the Monroe Auditory Discrimination Test (1932), the Roswell-Chall Auditory Blending test (Roswell and Chall,1963), the Roswell-Chall Diagnostic Reading Test (Roswell and Chall, 1959), and the Rosner Auditory Word Analysis (Rosner and Simon, 1970). In the Rosner test, a child is told a word and instructed to repeat it, leaving out a component sound from that word; for example, the child is told to repeat "eskimo," and, after he does so, is told "now say it without 'ki'."

Reading and Other Academic Tests. As reported above, individual tests of reading included the WRAT and Gray Oral Reading Test. However, these tests do not provide an adequate measure of a child's ability to read phonetic English, since much of their content is non-phonetic. None of the tests standardized in the United States includes phonetic content exclusively. It was important to have a reading test with phonetic content well-represented since some children might not progress to

word recognition of non-phonetic vocabulary, and, therefore, in such instances, treatment effects would remain undetected in spite of successful training in important aspects of reading.

In order to have an individual reading test with phonetic content, the tests presented by Daniels and Diack were included (1973). The drawback of the test is that grade equivalents, derived from British children, are available only through the 5th grade. For the purposes of this study, this shortcoming was relatively minor since the children were all below this level. However, in the assessment of improvement, the upper limit of the test might place an unduly low ceiling on measured performance in some cases. This test characteristic would have the effect of limiting the opportunity to detect treatment effects.

Objections might be raised concerning the use of a British test in American children for whom norms are not available. Since performance on this test was not a selection criterion in the study, and was not used to define or quantify reading lag in the sample, this issue does not appear relevant to the study goals.

The Stanford Achievement test was selected as a self-administered, timed, paper and pencil reading measure. It includes several tests of language (comprehension, vocabulary, spelling, etc.), as well as tests of mathematics, social science, and science. The test was administered individually, under the supervision of a professional. The Stanford Achievement Test has different versions for different grades. The level appropriate to each child's chronological grade level was used.

The Spelling and Arithmetic tests of the WRAT were also administered. For the spelling test, words are read to the child; sentences are then read, each containing one of the words previously mentioned; after each dictated sentence, the child is asked to write the word at issue. On the arithmetic tests, 10 minutes are allowed to complete as many problems as possible; these are presented in a computational format, without any prose.

Psychological Tests. In addition to the WISC-R, the following psychological tests were given. Two tests purported to tap attention were included: a continuous performance test, and the Matching Familiar Figures Test. A test of rote learning--a Paired Associate test--was administered. The Visual Sequential Memory test of the Illinois Test of Psycholinguistic Abilities was used as a measure of visual memory in which retaining the sequential organization of visual stimuli is called for. The Raven's Coloured Progressive Matrices were included as a measure of nonverbal reasoning,* and the Children's Embedded Figures Test,* as a visual perceptual test without a motor component. Tests of motor, or visual-motor, function were administered: the Purdue peg board, Porteus Mazes, Beery test of Visual Motor Integration (Beery, 1967), and the Draw-A-Person test.

Behavioral Assessments. A Teacher Rating Scale (Conners, 1969) was obtained from each child's teacher. The scale consists of 40 items and yields five factors, one of which, the Hyperactivity Factor, was used to select children who obtained low scores. In addition, teachers filled out a 13 item Behavioral Rating Scale,* with specific descriptions of attention, motor activity, and social behavior adapted from items reported by Rubin et al (1966). The psychologist who tested the children also completed this scale, the item content of which is listed in Table 14. A score of 1 always reflected the absence of disturbance, indicating normal, unremarkable behavior.

Mothers completed two rating scales: the Parent Questionnaire, a 93 item form rated from 0 to 3 (0 = not at all; 1 = just a little; 2 = pretty much; 3 = very much) (Conners, 1970), which yields eight factors; and the Home Hyperactivity Scale (Werry and Sprague, 1970), which includes 27 items scored from 0 to 4 (0 = not at all; 1 = very little; 2 = somewhat; 3 = quite a lot; 4 = very much), that describe the child's level or motor activity during meals, while watching tele-

*These measures were added during the course of the study and were therefore obtained only in a partial sample.

vision, doing homework, playing, sleeping, and while travelling with parents. The social worker also completed the latter scale from information obtained in interview with the mother. In addition to item scores, a single overall mean score was obtained for each child on the Home Hyperactivity Scale.

At the very end of treatment, teachers and mothers completed ratings of global improvement in academic performance (reading and arithmetic), and behavior.

Schedule of Assessments. Children were evaluated on reading and other academic tests, psychological tests, and behavioral rating scales before and at the end of the 18 week treatment period. Whenever several forms of the same test existed (e.g., Gray Oral, Porteus Mazes), a different form was used at different time points.

The children were reevaluated two and eight months after treatment termination (six and twelve months after treatment initiation) to determine whether gains, if any, were maintained over time.

Data Analyses

All pre-treatment measures were subjected to an analysis of variance to assess whether significant differences existed between the two groups before treatment.

Analyses of group differences after treatment consisted of two-group analyses of covariance of the post-treatment scores adjusted for pre-treatment values. (In this paper, we do not present analyses for heterogeneity of slope. In general, if both slope and level differences are significant, the reported level differences are conservative estimates of treatment differences.)

Global ratings of improvement were dichotomized and analyzed by means of X^2 tests.

The .05 level of probability was selected as the criterion of significance. In cases where the p values are greater than .05, but equal to or less than .10, they are presented for possible heuristic inferences. Though the predicted results were that the group receiving reading tutoring would be significantly superior to

the control group on tests of reading achievement and cognitive function, two-tailed tests of probability were applied to all group contrasts to provide conservative estimates of treatment differences.

Results

Subjects

A total of 61 children were randomly assigned to one of the two treatment groups. Of these, 33 were assigned to "motivated" reading remediation and placebo, 28 to attention control and placebo. Of the 33 in the reading group, three dropped out before the completion of the study. Two were withdrawn by parents shortly after treatment initiation due to reluctance about giving medication to their child. One child developed a seizure and was dropped from study. This youngster had no previous history of seizure disorder. A total of 30 children completed the 18 week experimental treatment program.

None of the 28 children assigned to attention control dropped out. However, through a pharmacy error, two received methylphenidate rather than a placebo. These two cases were omitted from all data analyses, which, therefore, include results from 26 children.

Table 1 presents the demographic characteristics of the children studied. Boys were over-represented in a 2:1 ratio of boys to girls. This sample is typical of the suburban population where the study was conducted: 80% were white, most (70%) were Christian; 80% were in the low to lower middle classes--Classes III and IV of the two index (occupation and education) socioeconomic status measure of Hollingshead and Redlich. The rest were distributed in the upper and lower classes (I and V). The children's full scale WISC-R IQ's ranged from 80 to 112. The mean IQ's of the groups were in the average range (Table 2). Children with high IQ's were conspicuously absent from the sample. Such children were simply not referred by teachers.

There are no norms for the basic reading skills measures used (presented in Tables 3 and 4), and scores cannot be interpreted readily.

Upon entry in the study, the children were reading at about the third grade level on the WRAT test of word recogntion, and at less than the second grade level on the Gray Oral Reading Test. The overall reading score on the Stanford Achievement Test was approximately at the third grade level. From these data, it is apparent that, on the average, the children had scores two years below grade level on several measures of reading competence (see Tables 5 and 6).

The design called for children who had no concurrent significant behavior disturbances, so that the effects of reading remediation could be evaluated in uncomplicated reading disorders. As may be noted in Table 11, the children received very low teacher ratings of disruptive or non-compliant behavior on the Teacher Rating Scale (Conners, 1969). The group mean scores on the Conduct Problems and Hyperactivity factors are indistinguishable from those reported in normal children (Sprague et al, 1974; Abikoff et al, 1977; 1980). The study children were not perceived as exceptionally anxious. However, the scores on the Inattention factor were relatively higher. The children also received very low scores on the Behavior Rating Scale from teachers and psychologists (Tables 12 and 13).

Similarly, the mean ratings done by mothers and social workers reflect very minimal problematic behaviors (Table 14).

Thus, all raters--teachers, mothers, and clinic staff--perceived the groups of children as displaying clinically insignificant amounts of behavior disturbance.

Group Differences before Treatment

In spite of the very large number of pre-treatment measures contrasted, none significantly differentiated the two groups, suggesting that randomization was effective.

Remediation Effects on Basic Reading Skills

Treatment effects on measures of basic reading skills and other auditory tests are presented in Tables 3 and 4. The remediated group received significantly better scores than the attention control group on almost all measures of basic reading skills of the so-called "auditory" tests (p's .03 to .0000). The Rosner word analysis test showed no specific treatment effect (p = .24).

Remediation Effects on Reading Achievement

The pre- and post-treatment scores obtained by each group on the WRAT, Gray Oral, Stanford Achievement Tests, and Daniels-Diack Oral Reading tests are given in Tables 5,6, and 7. After four months of treatment, the WRAT standard scores were significantly better in the remediation than in the attention control group ($p = .05$). The scores obtained by the remediation group on the Gray were also significantly superior to those of the controls ($p = .001$). The children who received tutoring showed a gain of a year on this test, whereas the children in the control group remained at the same level of performance, despite the passage of time (see Table 5).

As indicated in Table 6, the Diack tests showed consistent, highly significant group differences (p's .01 to .0001), all favoring the children who received reading instruction.

The results obtained on the Stanford Achievement are given in Table 7. (Since the various grade levels of the test differ in their subtest content, the number of children on some tests is less than the total sample.) Positive effects of remedial reading on the children's performance on the self-administered Stanford Achievement were not found across all reading measures of this paper and pencil test. However, when significant, differences always favored the treated group (Table 7). This group obtained significantly higher scores than the controls on two of the four language tests: Reading comprehension ($p = .03$) and Word Study Skills ($p = .02$). The Vocabulary test showed a trend favoring the treated group.

Remediation Effects on Academic Subjects Other Than Reading

The children's scores before and after treatment on the mathematics, social science, and science tests of the Stanford Achievement Test and on WRAT spelling and arithmetic tests are given in Table 8.

The children who received reading remediation obtained significantly lower

scores than the controls on the Mathematics Computation test of the Stanford Test ($p = .02$). There was also a trend for the control children to obtain higher scores on the Math Application test ($p = .08$). There were no differences in social studies and science scores between the two groups.

The WRAT arithmetic and spelling tests did not show differential treatment effects.

It is important to recall that the attention control group received tutoring in these subjects, with the exception of spelling.

Remediation Effects on Cognitive Tests

None of the cognitive test scores differed significantly between the two groups after treatment. IQ scores were no different between the groups (Table 9), nor were any of the scores on the cognitive and psychomotor tests (Table 10).

Remediation Effects on Behavioral Ratings

The post-treatment behavioral ratings obtained from teachers, mothers, and psychologists are presented in Tables 11, 12, 13, and 14. The factor scores of the Teacher Rating Scale did not show a difference between the two treatment groups (Table 11). The 40 individual items of this scale were analyzed for possible group contrasts; none differentiated between the two groups. The teacher ratings on the Behavioral Scale also failed to indicate treatment group differences (Table 12).

Similarly negative results were obtained on the behavioral evaluations done by psychologists, mothers, and social workers (Tables 13 and 14), except for the Immaturity Factor of the Parent Questionnaire (Table 14), on which the children who received reading remediation were significantly better ($p = .02$). In addition to the factor and sum scores of the Rating Scales, the 93 items of the Parent Rating Scale were analyzed. Four were significantly different between the groups: two indicated greater deviance in the remediation group, and two in the control group (p's $< .04$ to $< .02$). None of the items of the Home Hyperactivity Scale differentiated the two groups significantly.

On global ratings of improvement, teachers did not report that the children who had received reading therapy were significantly better than those who had not on any function rated, i.e., overall academic performance (X^2 = .46, n.s.), reading (X^2 = .03, n.s.), arithmetic (X^2 = .06, n.s.). A relatively small proportion of the children (21%) were viewed by their teachers as improved in academic performance.

Long-Term Effects of Reading Remediation

Reevaluation was scheduled two and eight months after termination of tutoring. None of the children retested at follow-up had received any interim individual remediation, and transfer to special classes was deliberately avoided to minimize effects of intervening treatment prior to reevaluation. At the two months follow-up, one of the 30 children in the reading group had moved and was unavailable for testing. At the eight months follow-up, three were not evaluated: one had moved; one refused; and the third, having received remediation after the two months follow-up testing, was dropped from the long-term reevaluation sample.

All the 26 children in the attention control group were reevaluated at the two months follow-up period. Five could not be assessed at the second reevaluation: two refused to cooperate, and three had moved out of the area.

The group differences obtained at the two and eight month follow-ups are presented in Tables 15 to 20. The children who had received reading remediation continued to perform significantly better than the controls on both the Pollack and Roswell-Chall tests, which assess the ability to decode various types of written material (Tables 15 and 16). The results indicate that the instruction received in these specific skills was retained by the children over time.

Table 17 indicates the group scores at two and eight months on the Gray Oral Reading Test and the WRAT. The children who received reading remediation were no longer superior to the controls on the Gray Oral test at either follow-up point.

Two months after termination of training, a significant treatment difference

was obtained on the WRAT reading tests in favor of the children given reading remediation ($p = .006$). After eight months, this advantage was no longer evident.

In contrast to the above results, scores on the phonetic reading Daniels and Diack Tests indicated that the children who had received reading remediation continued to perform significantly better than those who had not, at both follow-up periods.

As presented in Table 18, after two months of treatment, the children who had received remediation performed significantly better than controls on all measures of the test (p's .03 to .00001). After eight months, the Reading Age test continued to differentiate the groups ($p < .004$), indicating a maintenance of the effects of remediation over a relatively extended period of time on the phonetic reading material. Half the other reading measures on this test also continued to show an advantage for the treated group after eight months of treatment (p's $< .04$ to $< .01$).

The Word Study Skills test of the Stanford Achievement test showed a significant advantage for the remediation group two months after treatment termination ($p < .03$). None of the other four reading tests of the Stanford Achievement test did so. Eight months after the cessation of treatment, there were no significant group differences on the paper and pencil academic tests other than reading. These data are presented in Table 19.

At follow-up, no significant treatment differences were obtained on the non-reading academic tests. Thus, as may be noted on Table 20, the performance of the two groups of children was indistinguishable on the WRAT arithmetic and spelling tests, and on the Stanford Achievement tests of mathematics, social studies, and science.

Discussion

The major finding of this study is that the use of an intensive phonetic teaching program over a four month period induced significant changes in the reading ability of children with pure reading disorders. Remarkably, the effect of treat-

ment continued over time, so that the children who had received reading instruction were performing, up to eight months after treatment ceased, significantly better than those who had not received such instruction. As expected, the long-term treatment differences were much less salient than those obtained immediately after treatment. The fact that long-term effects occurred at all fosters the hope that reading remediation may not be an interminable intervention for children with reading disorders.

A positive feature of this study is the inclusion of a control group which received the same degree of both social and extrinsic tangible reinforcements as the reading group. Consequently, the improvement obtained in the reading group immediately after treatment, as well as over time, can be attributed directly to reading instruction specifically, and not to the motivational or psychosocial aspects of the treatment program. The two small studies of reading remediation done so far (Camp and Van Doorninck (1971; Cashdan and Pumfrey, 1973) used untreated controls, and in only one of these was the untreated condition random. If differences occur in such comparisons in favor of the treated children, it is difficult, if not impossible, to identify their origin. Are they due to the curricula taught, to a strong positive pupil-teacher interaction, to altered parental attitudes, etc.?

The fact that the control group was significantly superior to the reading remediation group on the Stanford Achievement Mathematics Computation test reflects the special tutoring in mathematics for the control group. However, this treatment effect was not maintained over time; at follow-up, the children who had been tutored in math did not perform better on the mathematics test than the children who had not received math instruction. Though the children in the control group also received tutoring in social science and science, they did not show an advantage on achievement tests in these disciplines. These differential treatment outcomes are subject to several interpretations. One is that, in the absence of reading instruction, there was little opportunity for children to gain much from tutoring in school subjects such as social science, which requires reading for adequate performance.

Second, it is conceivable that the improvement in these academic tasks for children who received reading remediation was due to improved reading, and that this treatment was as effective as specific tutoring in social science and science; consequently, no differences between the two groups occurred. Subsequent data analyses will be conducted to clarify whether improvement in reading led to improved achievement scores in social science and science.

Alternatively, it is possible that the control children who were specifically tutored in science and social science did gain significantly compared to the other group, but that the content of the Stanford Achievement test did not reflect adequately the aspects of knowledge included in the teaching program. Since the study was designed to examine whether remediation in academic subjects other than reading benefited children with reading disorders, little attempt was made to obtain multiple samplings of the children's competence in these subjects.

Slight improvement in reading among the children in the control group occurred over the course of the experiment. Since the study did not include a group of children randomly assigned to receive no treatment, changes in reading performance observed in the control group cannot be interpreted as being due either to the characteristics of the teaching program or to the passage of time. Even if one erroneously interpreted the entire changes in the control group as due to the reinforcement given the child for learning, or to the therapeutic impact of the treatment procedures, one would have to conclude that non-specific interpersonal components of intensive tutoring have very little influence on the reading progress of children with reading disorders. It is not uncommon in clinical settings for professionals to believe that a child's relationship with his tutor is the crucial element of the teaching program, and that the formal content of the curricula may be relatively unimportant.

This line of reasoning goes on to argue that the most one can do for a learning disordered child is to help him develop a more confident attitude toward learning and school, so that he can capitalize on developmental changes which enable him to acquire more skills as he matures. Given this model, it would not only be pointless to remediate children with reading disorders, it would be potentially harmful since the youngster would be confronted repeatedly with his own shortcomings without having gained the resources to profit from such confrontation. One group of investigators has come to the conclusion that children at risk for reading disorders become worse in reading and experience a drop in IQ if taught to read (Arnold et al., 1977). The study by Arnold et al supports the value of perceptual training, epitomizing the view that teaching reading is beside the point, at least for children at risk for learning disorders. This study has been criticized by Gittelman (1978).

The children in our study all received a placebo. The exact effects of this condition cannot be established since a group that did not receive pills was not included. However, as with the non-specific effects of attention, the presence of a placebo cannot be viewed as leading to any substantial changes, since the gains observed in the reading skills of the control group did not equal those which could be expected with maturation alone.

The results we report indicate that the active ingredient in the acquisition of reading skills for children with reading problems is reading instruction, and that the psychotherapeutic or placebo factors in tutoring lead to very unimpressive changes; certainly the teaching of reading does not lead to decrements in reading, nor does it expose children to the risk of IQ losses, as the study by Arnold et al claims (Arnold et al, 1978).

The approach used in the remediation program was based on the phonetic approach to reading instruction. This method was clearly effective, and, on some measures such as the Gray Oral Reading test, the gains associated with treatment were substantial--a whole grade level. However, it is not known whether it is more effective, or less so, than other teaching tactics. Given the negative results obtained with the use of perceptual remedial techniques in children with reading disorders, we suspect that our approach is more fruitful than perceptual training approaches.

In spite of the encouraging results obtained in this study, several sobering observations are in order. First, though the reading program led to significant improvement, many of the children, at the end of treatment, would have qualified as subjects for the study. Though they were reading better, they were not normal readers. Further, in spite of the objective findings of improved reading in the treated children, teachers failed to rate the children as significantly more improved in academic performance than the controls. An aspect

of the study not directly reflected in the scores may have affected the teachers' overall ratings of the children's academic performance. It was our distinct impression that the treatment program was much resented by teachers. There was no way that children could be seen three times a week without their missing school at least two hours a week, for 18 weeks; and entire day absences were required for evaluations. Unwittingly, the message communicated to teachers was that our intervention was more important than their instruction. This perception was not wholly inaccurate; we did believe that the children's previous lack of school success did not make school absences an especially noxious event, and we did not evince concern about them. Though this view was never openly expressed to the schools, our actions communicated it, and much negative feeling ensued from teachers. Perhaps it minimized their willingness to recognize progress in children who had received reading remediation. We do not intend to imply that this factor was the responsible one in the lack of teacher rated improvement. It is quite likely that the improvement associated with reading remediation was insufficient to enable the children to cope better with the relatively complex demands of their classroom.

The cessation of treatment after four months was arbitrary and not subject to the predilections of the staff, parents, or child. This procedure was mandated by the experiment; it would not be adopted in clinical practice, and in no case did we feel that the intervention had lasted a sufficient period of time. In the design of treatment studies, it is difficult to select lengths of treatment which ensure the detection of treatment effects, should these exist, and which minimize Type II errors, while at the same time having a time span which is not unduly lengthy, in order to avoid subject attrition. In the study of children, very extended study periods are especially problematic since marked developmental changes

are bound to occur, independent of any experimental manipulations. This increase in error variance may blur the detection of treatment effects in relatively small samples if too much time is allowed to elapse. From the results reported, it appears that a four month period of reading remediation, given three times a week, is ample to detect effects; however, in groups of children selected in the fashion used in this study, it is not sufficient to transform them into normal or even near normal readers. We feel confident that much more improvement is possible with further training. This optimism is founded only on clinical experience: many of the children were treated after the termination of the follow-up with considerable apparent benefit. Whether the reading disorder can be eradicated is difficult to estimate, since it requires the opportunity to follow treated children well beyond the cessation of treatment.

Second, the expectation that self-image, self-confidence, and attention (as rated by adults) are altered in children with pure reading disorders simply by improving their reading seems unwarranted. In this study, changes which distinguished the two treatment groups were always in academic areas. It is, of course, conceivable that with longer treatment this pattern might be altered. The five behavioral measures which showed significant group contrasts were most likely due to chance: in two cases the reading group was worse; in the other three, the control group was worse. Furthermore, even though significant, the magnitude of the differences between the groups was miniscule and of no clinical import.

Third, an exclusively phonetic approach to the remediation of reading disability may be insufficient to transmit the skills necessary for the mastery of broad reading skills. Though performance on all reading measures was significantly improved by treatment, reading on the phonetic test was most affected. Furthermore, the phonetic test was the only one which showed a consistent continuation of treatment effects. With time, the other reading tests did not reflect an advantage for the remediated children. Yet, it cannot be said that reading was not affected over time. The issue pertaining to the nature of the reading material used to assess change is largely

ignored in studies of reading performance. In some, not exceptional, instances, the Wide Range Achievement Test alone is used (e.g., Arnold et al., 1978) as a criterion for reading competence. This measure taps only word recognition, and therefore is not a valid representation of the reading process; furthermore, it has only a few phonetic words at very early reading level. Though our intention was to move beyond the phonetic word analysis during the course of treatment, this was not feasible for most children given a four month treatment period.

It would be erroneous, from the findings on the WRAT Spelling test, to conclude that spelling is not affected by reading remediation. Though some spelling remediation was part of the program, only its very rudimentary aspects were tackled, precluding the possibility of making a significant difference to children's spelling skills on a test such as the WRAT, which includes much non-phonetic material. Thus, on the Pollack spelling test, which is limited to phonetic content, the children who received remediation were significantly better spellers than the controls ($p < .0001$).

The tests of reading, arithmetic, and spelling of the Wide Range Achievement Test emerge as poor measures for the detection of progress in academic ability. Though a significant improvement was obtained on the reading test, its clinical importance is not impressive since the treated children only had a 3 point standard score advantage (Table 5). The tests have several positive characteristics: they are well standardized, applicable to a very wide age range (from preschoolers to adults), and brief, therefore requiring a short time for completion. The practical advantage of test brevity, however, is probably the main disadvantage for measuring change, since the test does not sample sufficiently a child's competence at each level of difficulty.

The Rosner test, which purports to tap auditory analytic skills, and therefore has been claimed to reflect an important dysfunction in the reading process, was unaffected by the teaching of reading. Both groups improved on this measure, which, in view of the results, does not appear relevant to the assessment of progress in children with reading disorders.

There was a trend ($p = .09$) for children in the control group to obtain higher IQ scores. It must be noted first, that the difference is not significant; second, that the difference between the groups, such as it is, does not represent a decrement in IQ for the treated children, but only a somewhat smaller gain; and third, that the magnitude of the difference, which is less than 3 points, is small and does not represent a functional difference in mental ability, even if it were found statistically significant in larger samples.

It bears emphasizing that the program used included the systematic use of reinforcement, which made a tremendous difference in obtaining the children's cooperation. Youngsters who are poor readers are typically not eager to receive tutoring, and the teacher is usually confronted by reluctant, if not resentful, cooperation. This attitude is not eliminated in all children when one uses a reinforcement program; but it is greatly minimized, and, in many instances, sullen compliance is replaced by eager participation. This difference in the children's attitude does much, in turn, for the morale of the teachers. The fact that we excluded children with clear behavioral problems may lead to the erroneous impression that the youngsters were eager to cooperate. Quite to the contrary, most were willing victims at best, and obtaining their active involvement was of concern in many cases. The children clearly valued the chips and were highly motivated to come to the clinic. The rate of attendance was extremely high. The reward program interfered with the teaching of only one child. This youngster was so eager to collect more points that he tried to race through the materials; the system was altered to reward him to be careful and go more slowly, and it worked well from then on.

The mean age of the children in the study was slightly higher than 10 years; most were in their fifth year of schooling. This suggests that teachers tended to refer children who had shown a long-established pattern of reading failure, or children whose reading difficulties affected multiple aspects of school work. In the United States, reading becomes crucial to academic performance in most or all school subjects during the third year of schooling, when children are 8 years old. If the referral pattern obtained in this study reflects teacher identification of reading disorders, it indicates that, by and large, reading problems are not commonly identified in younger age groups.

There are no established procedures for the identification of children with reading disorders. How much behind grade level should children be? Should verbal IQ alone or full IQ be considered when evaluating the discrepancy between intellectual competence and reading? How many measures of reading need one obtain to confirm dysfunction, and which ones? The fact that these questions remain unresolved reflects the scarcity of knowledge concerning the validity of various definitions of reading disorders. For example, the long-term fate of children identified by various definitional standards and techniques is not known. Yule has pointed out that certain statistical characteristics of the tests (i.e, lack of linear relationship between IQ and reading scores) required consideration in identifying children with reading disorders (Yule, 1967). The point raised here is important if one is selecting children with reading disorders from a larger, unselected group; it does not, however, apply if one is quantifying a reading lag in a child already identified.

In this study, the identification of children followed several steps. The first consisted of a teacher's judgment that the child was in academic difficulty, leading to referral to a child psychiatric clinic. The procedures necessary for teachers to implement referrals are time-consuming and sometimes problematic, since they require the school to contact the parents, inform the parents of teacher evaluations, counsel them to seek treatment, and then provide information to the treatment center. Therefore, school referrals rarely occur for trivial reasons. Consequently, the children in this study represent a clinically dysfunctional group. Yet, even in such an instance, issues of the appropriateness of criteria for confirmation of reading disorders remain unclear. It is reasonable to assume, as has been suggested, that a fixed reading lag has different functional significance at different ages. Yet, there is no way to estimate equivalences of decrement for

all ages. Our original intention was to include only children who were two years below grade level on objective reading tests. However, so many children were referred who did not meet this criterion on all reading tests that it was decided it had been unduly rigorous, given our intention to study reading remediation effects in children who had difficulties in school because of reading disorders. It would be a mistake to assume that by using the same test criteria, in the absence of teacher referrals, a similarly severely affected group of children would be identified.

In the complete absence of documented efficacy for any remediation treatment of reading disorders, it is ironic that there has been so much interest in the subtyping of these disorders, with the implicit promise that treatment efficacy is thereby maximized. This goal is ambitious, but as yet undocumented. Attempts to assess whether children are poor readers because of weaknesses in one sensory modality versus another (such as visual rather than auditory) represent types of pseudo-exact and pseudoscientific assessments, since no validity for such findings has been generated. If anything, the weight of the evidence is that sensory weaknesses do not predict responses to different teaching approaches (Robinson, 1972). Therefore, until controlled support for the specificity of intervention for discrete subgroups of reading disorders appears, the best evidence suggests that intensive training of phonic skills should be used to improve reading performance in children with reading disorders, regardless of other diagnostic refinements--whether based on perceptual, motor-perceptual, or neuropsychological test performance.

Table 1

Demographic Characteristics

Group Characteristic	Treatment Group: Reading Remediation (N = 30)	Attention Control (N = 26)	Total (N = 56)
Age (in months)			
Mean	120.5	123.5	121.89
s.d.	15.0	13.4	14.25
	Percent	Percent	Percent
Sex			
Boys	60	73	66
Girls	40	37	34
Race			
White	77	85	80
Black	23	15	20
SES			
I & II	13	12	12
III	30	31	30
IV	57	42	50
V	0	15	8
Religion			
Protestant	23	23	23
Catholic	37	61	48
Jewish	30	11	21
Other or None	10	4	7

Table 2

Study Criteria of Reading Achievement by Verbal IQ and Distribution in Sample (N = 56)

Verbal IQ	Reading Lag Required*	N
85 - 90	2 years	16
91 - 95	1.5 years	19
96 and over	1.0 years	21

* Lag between grade level and test scores.

Table 3

Pre-Treatment* and Post-Treatment** Mean Values on

Pollack Auditory and Basic Reading Skills Tests

Test	Treatment Period	Treatment Group: Reading Remediation (N = 30) Mean	s.e.	Attention Control (N = 26) Mean	s.e.	ANCOVA t	p++
Auditory							
Phoneme Discrimination (% correct)	Pre	90.60	1.77	92.77	1.62		
	Post	99.62	.83	94.66	.90	4.03	.0002
Blend Score (% correct)	Pre	49.33	4.83	55.81	5.15		
	Post	96.70	2.38	69.12	2.56	7.85	.0000
Basic Reading Skills+							
Initial Consonants Oral	Pre	1.93	.40	1.46	.33		
	Post	.25	.12	.45	.13	1.24	n.s.
Initial Consonants Written	Pre	.90	.44	.15	.07		
	Post	.00	.11	.35	.12	2.19	.03
Blending Separate	Pre	4.77	.43	4.50	.39		
	Post	.63	.30	4.15	.32	8.08	.0000
Blending Blended	Pre	5.17	.40	4.38	.42		
	Post	.83	.29	4.66	.31	9.07	.0000
Rhyming Verbal	Pre	.93	.26	.81	.20		
	Post	.06	.16	.47	.17	1.78	.08
Rhyming Written	Pre	1.40	.27	1.38	.31		
	Post	.13	.16	.85	.17	3.04	.004
Vowel Discrimination	Pre	1.80	.26	1.58	.27		
	Post	.52	.20	1.55	.21	3.58	.001
Final Consonants	Pre	1.47	.19	1.08	.19		
	Post	.18	.16	1.14	.17	4.08	.0002
Rule of Silent E	Pre	3.10	.36	2.96	.39		
	Post	.97	.28	2.72	.30	4.28	.0001
Spelling	Pre	4.30	.45	4.04	.44		
	Post	1.46	.28	3.55	.30	5.03	.0000

(Table 3 continued).

Dictation	Pre	2.63	.36	2.73	.42		
	Post	.18	.18	1.87	.20	5.34	.0000
Comprehension	Pre	1.97	.45	1.12	.32		
	Post	.49	.20	1.11	.21	2.12	.04
Rosner Auditory Analysis[x]							
	Pre	-14.67	1.18	-14.12	1.75		
	Post	- 7.68	1.29	- 9.96	1.38	1.20	n.s.

* For the sake of brevity and readability, the specific t and p values for group comparisons before treatment are not presented since none was significant at the p = .05 level.

** All post-treatment means adjusted for pre-treatment values.

+ Number of errors

++ two-tailed tests

[x] Difference between child's score and norm for age (negative score indicates poor performance)

Table 5

Pre-Treatment* and Post-Treatment** Mean Levels on

Gray Oral Reading (GOR) and Wide Range Achievement Tests (WRAT)

Reading Test	Treatment Period	Treatment Group: Reading Remediation (N = 30) Mean	s.e.	Treatment Group: Attention Control (N = 26) Mean	s.e.	ANCOVA t	p++
GOR (Grade level)	Pre	1.97	.09	2.16	.15		
	Post	2.97	.14	2.22	.15	3.47	.001
WRAT (Standard Scores)	Pre	85.30	1.74	84.73	2.23		
	Post	87.79	1.04	84.67	1.12	2.04	.05

*For the sake of brevity and readability, the specific t and p values for group comparisons before treatment are not presented since none was significant at the p = .05 level.

**All post-treatment means adjusted for pre-treatment values.

++two-tailed tests

Table 4

Pre-Treatment* and Post-Treatment** Mean Values on Monroe Auditory Discrimination and Roswell-Chall Auditory Blending and Diagnostic Reading Tests

Treatment Period		Treatment Group: Reading Remediation (N = 30) Mean	s.e.	Treatment Group: Attention Control (N = 26) Mean	s.e.	ANCOVA t	p++
Monroe Auditory Discrimination+	Pre	.77	.19	.62	.22		
	Post	.19	.09	.50	.10	2.32	.023
Roswell-Chall Auditory Blending×	Pre	27.07	.72	27.23	.75		
	Post	29.65	.25	28.79	.27	2.36	.02
Roswell Chall Diagnostic Reading+							
Single Consonant Sounds	Pre	4.03	.70	3.04	.45		
	Post	.31	.20	2.21	.22	6.28	.0000
Consonant Combination	Pre	3.93	.49	4.27	.53		
	Post	1.24	.33	3.03	.35	3.72	.0005
Short Vowels	Pre	10.79	1.11	10.58	1.01		
	Post	.76	.68	8.31	.72	7.66	.0000
Rule of Silent E	Pre	3.90	.50	3.54	.58		
	Post	.86	.29	2.97	.31	5.02	.0000
Vowel Combination	Pre	6.37	.66	5.92	.72		
	Post	3.86	.40	5.24	.43	2.37	.02
Syllabification	Pre	6.10	.25	6.15	.34		
	Post	7.62	1.59	6.05	1.71	.67	n.s.

* For the sake of brevity and readability, the specific t and p values for group comparisons before treatment are not presented since none was significant at the p .05 level.

** All post-treatment means adjusted for pre-treatment values.

+ Number of errors

++ two-tailed tests

× Number correct

Table 6

Pre-Treatment* and Post-Treatment** Mean Values

on Daniels-Diack Phonetic Reading Tests

Test	Treatment Period	Treatment Group: Reading Remediation (N = 30) Mean	s.e.	Treatment Group: Attention Control (N = 26) Mean	s.e.	ANCOVA t	ANCOVA p++
Oral Reading Test							
Reading Age (in months)	Pre	84.14	2.46	84.46	3.08		
	Post	96.80	1.02	90.08	1.07	4.06	.0002
Reading Quotient	Pre	70.69	1.84	69.23	2.56		
	Post	77.71	1.12	72.66	1.18	3.09	.003
Word Recognition+							
Phonically Simple (15)	Pre	2.73	.51	2.73	.53		
	Post	.17	.27	1.96	.29	4.61	.0000
Consonant Blends Beginning (22)	Pre	9.10	1.00	9.92	1.17		
	Post	3.03	.48	6.97	.52	5.55	.0000
Consonant Blends Ending (16)	Pre	5.50	.69	5.88	.83		
	Post	1.80	.27	3.93	.29	5.39	.0000
Polysyllabic-Phonically Simple (15)	Pre	7.70	.79	8.15	.81		
	Post	4.50	.40	6.20	.43	3.15	.003
Graded Phonically Complex (52)	Pre	19.87	2.32	20.58	2.82		
	Post	11.41	.96	15.99	1.03	3.42	.002
Common Words (20)	Pre	4.03	.71	4.42	.82		
	Post	1.82	.29	3.40	.31	3.91	.0003
Reversible Words (12)	Pre	5.33	.63	4.92	.67		
	Post	1.83	.30	4.20	.33	4.87	.0000
Nonsense Syllables (12)	Pre	8.63	.54	7.62	.67		
	Post	2.16	.38	6.93	.41	8.48	.0000

* For the sake of brevity and readability, the specific t and p values for group comparisons before treatment are not presented since none was significant at the p =.05 level.

** All post-treatment means adjusted for pre-treatment values.

\+ Number of errors

++ two-tailed tests

() parentheses indicate maximum score possible.

Table 7

Pre-Treatment* and Post-Treatment** Mean Grade Levels

On the Stanford Achievement Reading Tests

Subtest	Treatment Period	Treatment Group: Reading Remediation (N = 27-30)x Mean	s.e.	Treatment Group: Attention Control (N = 21-26)x Mean	s.e.	ANCOVA t	p++
Vocabulary	Pre	3.54	.20	3.42	.27		
	Post	4.35	.17	3.94	.18	1.68	.10
Reading Comprehension	Pre	2.94	.21	3.28	.24		
	Post	4.01	.15	3.54	.16	2.18	.03
Spelling	Pre	3.15	.27	3.33	.28		
	Post	3.81	.16	3.70	.17	.50	n.s.
Word Study Skills	Pre	2.77	.23	2.87	.20		
	Post	3.91	.16	3.30	.18	2.51	.02
Language	Pre	2.89	.31	2.71	.37		
	Post	3.75	.20	3.57	.20	.22	n.s.

* For the sake of brevity and readability, the specific t and p values for group comparisons before treatment are not presented since none was significant at the p = .05 level.

** All post-treatment means adjusted for pre-treatment values.

++ two-tailed tests

x all tests were not available at all levels.

Table 8

Pre-Treatment* and Post-Treatment** Mean Values

on Academic Tests Other Than Reading

Test	Treatment Period	Treatment Group: Reading Remediation (N = 26-30)+ Mean	s.e.	Treatment Group: Attention Control (N = 24-26)+ Mean	s.e.	ANCOVA t	p++
WRAT (Standard Scores)							
Arithmetic	Pre	91.63	1.70	89.24	2.45		
	Post	87.85	1.31	88.10	1.43	.14	n.s.
Spelling	Pre	84.50	1.74	84.80	2.46		
	Post	85.92	.97	83.66	1.06	1.58	n.s.
Stanford Achievement (Grade Levels)							
Math Computation	Pre	4.06	.30	4.15	.32		
	Post	4.78	.15	5.32	.16	2.51	.02
Math Concepts	Pre	3.44	.20	3.72	.26		
	Post	4.45	.16	4.39	.17	.26	n.s.
Math Application	Pre	3.52	.26	3.58	.29		
	Post	4.26	.19	4.75	.20	1.79	.08
Social Studies	Pre	3.31	.25	3.24	.28		
	Post	4.13	.16	4.35	.17	.96	n.s.
Science	Pre	3.07	.22	3.44	.27		
	Post	3.96	.22	3.59	.22	1.54	n.s.

* For the sake of brevity and readability, the specific t and p values for group comparisons before treatment are not presented since none was significant at the p = .05 level.

** All post-treatment means adjusted for pre-treatment values.

+ All tests were not available at all levels

++ two-tailed tests

Table 9

Pre-Treatment* and Post-Treatment** Mean Values

on WISC-R IQ Test

IQ	Treatment Period	Treatment Group: Reading Remediation (N = 30) Mean	s.e.	Attention Control (N = 26) Mean	s.e.	ANCOVA t	p++
VIQ	Pre	95.37	1.32	93.88	1.21		
	Post	96.19	1.04	97.20	1.12	.66	n.s.
PIQ	Pre	97.63	1.70	94.42	2.74		
	Post	105.60	1.74	109.03	1.88	1.33	n.s.
FISQ	Pre	96.03	1.39	93.42	1.73		
	Post	100.36	1.12	103.16	1.20	1.70	.09

* For the sake of brevity and readability, the specific t and p values for group comparisons before treatment are not presented since none was significant at the p = .05 level.

** All post-treatment means adjusted for pre-treatment values.

++ two-tailed tests

Table 10

Pre-Treatment* and Post-Treatment** Mean Values

on Psychological Tests

Test	Treatment Period	Treatment Group: Reading Remediation Mean	Reading Remediation s.e.	Attention Control Mean	Attention Control s.e.	ANCOVA t	ANCOVA p++
Continuous Performance Task							
Errors of Commission	Pre	7.69	1.94	5.13	1.68		
	Post	3.81	.83	2.03	.87	1.47	n.s.
Errors of Omission	Pre	2.81	.62	1.67	.60		
	Post	1.76	.39	.97	.40	1.40	n.s.
Paired Associate (# of Trials)	Pre	7.57	.60	6.38	.69		
	Post	4.91	.30	4.74	.31	.39	n.s.
Visual Sequential Memory Test	Pre	99.77	3.86	100.00	4.52		
	Post	107.40	3.56	109.92	3.83	1.24	n.s.
Children's Embedded Figures Test	Pre	10.93	1.22	11.38	1.30		
	Post	12.93	.95	12.58	.99	.26	n.s.
Raven's Matrices (percentile)	Pre	25.64	4.80	38.50	8.33		
	Post	39.23	5.28	32.83	5.39	.84	n.s.
Matching Familiar Figures							
Latency	Pre	11.97	.86	15.10	1.60		
	Post	12.45	1.08	12.83	1.18	.24	n.s.
Total Errors	Pre	12.27	1.14	11.12	1.35		
	Post	11.35	.88	9.31	.95	1.14	n.s.
Purdue Peg Board							
Right Hand	Pre	38.07	.85	41.23	.79		
	Post	43.08	.65	42.74	.66	.36	n.s.
Left Hand	Pre	37.32	.87	39.15	.88		
	Post	39.96	.72	40.03	.74	.06	n.s.
Both Hands	Pre	31.04	.80	33.08	.85		
	Post	34.58	.98	32.84	1.02	1.23	n.s.
Left, Right, & Both Hands	Pre	106.43	2.25	113.46	2.22		
	Post	117.99	1.68	115.35	1.72	1.08	n.s.
Assembly	Pre	75.59	3.08	83.04	3.41		
	Post	87.58	2.51	86.96	2.58	.17	n.s.

Porteus Mazes							
IQ	Pre	112.47	2.98	116.46	3.68		
	Post	117.22	2.19	121.44	2.36	1.30	n.s.
Qualitative Score	Pre	50.00	3.75	49.88	3.58		
	Post	56.18	3.69	60.06	3.96	.71	n.s.
Visual Motor Integration +	Pre	92.60	3.94	89.27	3.17		
	Post	92.58	3.40	92.45	3.66	1.24	n.s.
Draw A Person IQ	Pre	105.30	4.19	104.31	3.77		
	Post	104.75	2.72	103.53	2.92	.31	n.s.

* For the sake of brevity and readability, the specific t and p values for group comparisons before treatment are not presented since none was significant at the p= .05 level.

** All post-treatment means adjusted for pre-treatment values.

+ Mental Age (score corrected for chronological age).

++ two-tailed tests

Table 11

Pre-Treatment* and Post-Treatment** Mean Factor Scores[x]

Of the Teacher Rating Scale

Factor	Treatment Period	Treatment Group: Reading Remediation (N = 30) Mean	s.e.	Attention Control (N = 26) Mean	s.e.	ANCOVA t	p[++]
I Conduct Problems	Pre	.13	.10	.01	.11		
	Post	.17	.10	.14	.11	.20	n.s.
II Inattention	Pre	1.71	.16	1.58	.16		
	Post	1.25	.11	1.36	.11	.67	n.s.
III Anxiety	Pre	.60	.10	.81	.25		
	Post	.64	.12	.62	.12	.14	n.s.
IV Hyperactivity	Pre	.90	.10	.83	.12		
	Post	.83	.11	.89	.12	.24	n.s.
V Sociability[+]	Pre	-1.13	.00	-1.13	.00		
	Post	-1.45	.07	-1.42	.08	.24	n.s.

* For the sake of brevity and readability, the specific t and p values for group comparisons before treatment are not presented since none was significant at the p .05 level.

** All post-treatment means adjusted for pre-treatment values.

x score range, 0 - 3

+ negative item loadings

++ two-tailed tests

Table 12

Pre-Treatment* and Post-Treatment** Mean Values of Behavior Rating Scale Completed by Teachers

Item	Treatment Period	Treatment Group: Reading Remediation (N = 15) Mean	s.e.	Attention Control (N = 12) Mean	s.e.	ANCOVA t	p++
1. Activity (-2 to +7)	Pre	1.73	.36	1.67	.36		
	Post	1.45	.32	1.44	.35	.02	n.s.
2. Distractibility (1-5)	Pre	2.86	.27	2.50	.23		
	Post	1.45	.21	1.44	.23	1.12	n.s.
3. Frustration Tolerance (-1 to +5)	Pre	.57	.29	.75	.25		
	Post	.94	.20	.88	.22	.23	n.s.
4. Cooperation (1-5)	Pre	2.13	.23	2.25	.25		
	Post	1.89	.20	1.77	.23	.39	n.s.
5. Mood (1-6)	Pre	2.14	.42	2.25	.18		
	Post	1.97	.24	2.34	.26	1.05	n.s.
6. Attitude Toward Work (-1 to +5)	Pre	2.47	.49	3.10	.45		
	Post	2.67	.25	2.32	.29	.89	n.s.
7. Interest in Tasks (1-5)	Pre	3.07	.30	3.17	.32		
	Post	2.69	.18	2.64	.20	.18	n.s.
8. Anxiety about Failure (-2 to +5)	Pre	1.87	.51	2.08	.56		
	Post	1.38	.39	2.37	.43	1.88	n.s.
9. Attention Seeking Devices (1-5)	Pre	2.07	.27	1.58	.26		
	Post	1.92	.25	2.12	.28	.17	n.s.
10. Impulse Control (1-5)	Pre	2.10	.28	2.29	.36		
	Post	1.92	.25	2.12	.36	.42	n.s.
11. Initiation of Aggression (1-5)	Pre	.71	.27	1.14	.40		
	Post	1.94	.27	1.76	.34	.42	n.s.
12. Joining Aggressive Activities (1-5)	Pre	2.20	.36	2.00	.38		
	Post	1.64	.26	2.24	.30	1.54	n.s.
13. Popularity (1-5)	Pre	2.30	.40	2.14	.55		
	Post	2.26	.20	2.21	.23	.15	n.s.

(Table 12 continued)

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* For the sake of brevity and readability, the specific t and p values for group comparisons before treatment are not presented since none was significant at the p= .05 level.

** All post-treatment means adjusted for pre-treatment values.

++ two-tailed tests

(Range of scores in parentheses)

Table 13

Pre-Treatment* and Post-Treatment** Mean Values

of the Behavior Rating Scale Completed by Psychologists

Rating	Treatment Period	Treatment Group: Reading Remediation (N = 30) Mean	s.e.	Treatment Group: Attention Control (N = 26) Mean	s.e.	ANCOVA t	p++
1. Activity (-2 to +7)	Pre	1.50	.17	1.31	.13		
	Post	1.45	.13	.96	.14	2.59	.02
2. Distractibility (1-5)	Pre	1.53	.08	1.23	.08		
	Post	1.55	.11	1.50	.10	.16	n.s.
3. Frustration Tolerance (-1 to +5)	Pre	1.07	.05	1.00	.00		
	Post	1.07	.08	1.14	.09	.62	n.s.
4. Cooperation (1-5)	Pre	1.20	.55	1.08	.54		
	Post	1.15	.07	1.25	.07	.99	n.s.
5. Mood (1-6)	Pre	2.43	.33	2.81	.39		
	Post	2.02	.23	2.37	.24	1.07	n.s.
6. Attitude Toward Work (-1 to +5)	Pre	1.50	.16	1.27	.16		
	Post	1.73	.16	1.62	.18	.47	n.s.
7. Interest in Tasks (1-5)	Pre	1.93	.15	1.50	.17		
	Post	1.70	.15	2.03	.16	1.51	n.s.
8. Anxiety about Failure (-2 to +5)	Pre	1.13	.20	1.00	.21		
	Post	1.20	.18	1.24	.20	.18	n.s.
9. Attention Seeking Devices (1-5)	Pre	1.40	.16	1.10	.10		
	Post	1.51	.15	1.45	.16	.27	n.s.
10. Impulse Control (1-5)	Pre	1.75	.19	1.28	.13		
	Post	1.66	.17	1.45	.18	.81	n.s.

* For the sake of brevity and readability, the specific t and p values for group comparisons before treatment are not presented since none was significant at the p =.05 level.

** All post-treatment means adjusted for pre-treatment values.

++ two-tailed tests

Table 14

Pre-Treatment* and Post-Treatment** Mean Values
of Mothers' and Social Workers' Behavioral Ratings

Measure and Rater	Treatment Period	Treatment Group: Reading Remediation (N = 30) Mean	s.e.	Treatment Group: Attention Control (N = 26) Mean	s.e.	ANCOVA t	p++
Home Hyperactivity Scale							
Mother	Pre	1.90	.11	1.63	.13		
	Post	1.61	.07	1.59	.08	.28	n.s.
Social Worker	Pre	1.81	.10	2.06	.14		
	Post	1.69	.07	1.48	.08	1.91	.06
Parent Rating Scale (0 - 3)							
I Conduct	Pre	.51	.07	.53	.10		
	Post	.45	.03	.36	.04	1.81	.08
II Anxiety	Pre	.60	.08	.63	.10		
	Post	.45	.04	.43	.05	.52	n.s.
III Impulsivity	Pre	.45	.12	.44	.11		
	Post	.21	.06	.20	.06	.00	n.s.
IV Immaturity	Pre	.85	.07	.79	.07		
	Post	.55	.05	.74	.06	2.44	.02
V Psychosomatic	Pre	.26	.07	.24	.08		
	Post	.20	.04	.16	.04	.62	n.s.
VI Obsessional	Pre	.54	.14	.50	.14		
	Post	.36	.09	.29	.09	.55	n.s.
VII Antisocial	Pre	.66	.03	1.44	.40		
	Post	.36	.09	.29	.09	.43	n.s.
VIII Hyperactivity	Pre	.61	.06	.58	.07		
	Post	.41	.04	.42	.04	.20	n.s.

* For the sake of brevity and readability, the specific t and p values for group comparisons before treatment are not presented since none was significant at the p = .05 level.

** All post-treatment means adjusted for pre-treatment values.

++ two-tailed tests

Table 15

Mean Values at Two and Eight Months Follow-up

On Pollack Auditory Test

Subtest	Follow-up Period	Treatment Group: Reading Remediation Mean	Reading Remediation s.e.	Attention Control Mean	Attention Control s.e.	ANCOVA t	ANCOVA p++
Phoneme Discrimination (% correct)	2 Months	98.87	.57	97.25	.61	1.95	.055
	8 Months	98.83	.61	96.96	.69	2.58	.012
Blend Score (% correct)	2 Months	94.24	2.53	69.65	2.70	6.64	.000
	8 Months	93.92	2.45	76.61	2.80	4.07	.000

++ two-tailed tests

Table 16

Mean Values at Two and Eight Months Follow-up on Roswell-Chall Auditory Blending and Diagnostic Reading Tests

	Follow-up Period	Treatment Group: Reading Remediation Mean	Reading Remediation s.e.	Attention Control Mean	Attention Control s.e.	ANCOVA t	ANCOVA p++
Auditory Blending[x]	2 Months	29.53	.23	28.79	.24	2.27	.026
	8 Months	29.15	.27	29.20	.22	.24	n.s.
Diagnostic Reading[+]							
Single Consonant Sounds	2 Months	.88	.23	1.54	.25	1.92	.06
	8 Months	.72	.17	1.12	.20	.66	n.s.
Consonant Combination	2 Months	1.64	.36	2.23	.38	1.13	n.s.
	8 Months	1.37	.30	2.03	.33	1.84	.07
Short Vowels	2 Months	2.01	.72	8.64	.75	6.35	.001
	8 Months	2.20	.60	6.65	.67	4.44	.001
Rule of Silent E	2 Months	1.00	.33	2.81	.35	3.74	.001
	8 Months	1.34	.33	2.64	.36	2.53	.01
Vowel Combination	2 Months	3.39	.43	4.60	.46	1.93	.06
	8 Months	3.17	.44	3.78	.49	1.43	n.s.
Syllabification	2 Months	5.48	.28	6.02	.30	1.31	n.s.
	8 Months	5.07	.36	5.79	.40	1.71	.09

[x] Number correct

[+] Number of errors

[++] two-tailed tests

Table 17

Mean Values at Two and Eight Months Follow-up

On Gray Oral Reading and Wide Range Achievement Tests

Reading Test	Follow-up Period	Treatment Group				ANCOVA	
		Reading Remediation		Attention Control			
		Mean	s.e.	Mean	s.e.	t	p++
GOR (Grade Levels)	2 Months	2.67	.16	2.39	.17	1.66	.10
	8 Months	3.28	.21	2.95	.25	1.00	n.s.
WRAT (Standard Scores)	2 Months	87.26	.87	83.57	.94	2.88	.006
	8 Months	88.21	1.14	86.98	1.41	.68	n.s.

++ two-tailed tests

Table 18

Mean Values at Two and Eight Months Follow-up

on Daniels-Diack Phonetic Reading Tests

Test	Follow-up Period	Treatment Group: Reading Remediation Mean	Reading Remediation s.e.	Attention Control Mean	Attention Control s.e.	ANCOVA t	ANCOVA p++
Oral Reading Test							
Reading Age (in months)	2 Months	96.06	1.32	91.58	1.38	2.35	.03
	8 Months	100.05	1.25	94.29	1.39	3.08	.004
Reading Quotient	2 Months	75.82	1.20	71.39	1.25	2.55	.02
	8 Months	74.11	1.33	70.97	1.46	1.59	n.s.
Word Recognition+							
Phonically Simple	2 Months	.48	.17	1.53	.18	4.46	.000
	8 Months	.40	.24	1.45	.27	2.91	.006
Consonant Blends Beginning	2 Months	4.13	.61	6.77	.64	2.98	.005
	8 Months	3.20	.51	4.45	.57	1.64	n.s.
Consonant Blends Ending	2 Months	2.76	.39	4.07	.41	2.31	.03
	8 Months	2.00	.33	2.95	.37	1.42	.06
Polysyllabic-Phonically Simple	2 Months	4.65	.39	5.97	.40	2.35	.03
	8 Months	4.30	.34	5.24	.37	1.84	.07
Graded Phonically Complex	2 Months	11.19	1.04	14.99	1.08	2.54	.02
	8 Months	8.37	.93	12.11	1.01	2.73	.01
Common Words	2 Months	1.81	.33	3.45	.35	3.44	.001
	8 Months	1.55	.21	1.56	.23	.00	n.s.
Reversible Words	2 Months	1.88	.32	4.53	.33	5.73	.0000
	8 Months	1.88	.28	2.79	.31	2.16	.04
Nonsense Syllables	2 Months	2.95	.41	7.01	.43	6.80	.0000
	8 Months	3.38	.44	6.39	.48	4.58	.0000

+ Number of errors

++ two-tailed tests

Table 19

Mean Grade Levels at Two and Eight Months Follow-up

On Stanford Achievement Reading Tests

Subtest	Follow-up Period	Treatment Group				ANCOVA	
		Reading Remediation		Attention Control			
		Mean	s.e.	Mean	s.e.	t	p++
Vocabulary	2 Months	4.16	.21	3.98	.21	.60	n.s.
	8 Months	4.71	.23	4.60	.26	.28	n.s.
Reading Comprehension	2 Months	3.89	.17	3.57	.18	1.28	n.s.
	8 Months	3.92	.21	4.15	.25	.74	n.s.
Spelling	2 Months	3.75	.18	3.72	.19	.10	n.s.
	8 Months	4.63	.21	4.04	.24	.00	n.s.
Word Study Skills	2 Months	3.76	.18	3.12	.20	2.31	.03
	8 Months	3.94	.20	3.94	.21	.00	n.s.
Language	2 Months	3.80	.22	3.68	.22	.39	n.s.
	8 Months	4.18	.23	4.30	.32	.28	n.s.

++ two-tailed tests

Table 20

Mean Values at Two and Eight Months Follow-up

on Academic Tests Other Than Reading

Test	Follow-up Period	Treatment Group: Reading Remediation Mean	Reading Remediation s.e.	Attention Control Mean	Attention Control s.e.	ANCOVA t	ANCOVA p++
WRAT (Standard Scores)							
Arithmetic	2 Months	84.08	1.89	87.86	2.42	1.22	n.s.
	8 Months	86.34	1.29	86.33	1.29	.00	n.s.
Spelling	2 Months	84.86	1.20	83.41	1.53	.74	n.s.
	8 Months	83.70	1.14	81.86	1.26	1.09	n.s.
Stanford Achievement (Grade Levels)							
Math Computation	2 Months	4.50	.17	4.77	.18	1.09	n.s.
	8 Months	4.96	.26	5.50	.30	1.34	n.s.
Math Concepts	2 Months	4.12	.23	4.36	.24	.17	n.s.
	8 Months	4.81	.21	5.06	.24	.76	n.s.
Math Application	2 Months	4.48	.17	4.50	.18	.10	n.s.
	8 Months	4.41	.28	5.11	.32	1.65	n.s.
Social Studies	2 Months	3.93	.21	4.21	.21	1.10	n.s.
	8 Months	4.29	.28	4.94	.31	1.55	n.s.
Science	2 Months	3.91	.21	3.59	.21	1.09	n.s.
	8 Months	4.25	.26	4.21	.29	.10	n.s.

++ two-tailed tests

Appendix A

List of Materials Used in Reading Remediation Group

Reading

Traub, N. Recipe for Reading. Educators Publishing Service Inc., Cambridge, Mass., 1973, 1975.

Fries, C., Fries, A., Wilson, R., and Rudolph, M. Merrill Linguistic Readers and Workbooks. Science Research Associates, Inc., Chicago, Illinois, 1970.

Rasmussen, D. and Goldberg, L. The SRA Reading Program Basic Reading Series Readers and Workbooks. Science Research Associates, Inc., Chicago, Illinois, 1970.

Comprehension

Boning, R. Specific Skills Series. Barnell Loft, Ltd., Baldwin, New York, 1965.

Crowell, C. Reading Attainment Systems 1 and 2. Instructional Systems Division, Grolier Educational Corp., New York, New York, 1975.

Sight Word Vocabulary

Dolch, E.W. Popper Word Sets 1 and 2. Garrard Publishing Co., Champaign, Illinois, 1948.

Dolch, E.W. Basic Sight Vocabulary Cards. Garrard Publishing Co., Champaign, Illinois, 1948.

Dolch, E.W. Sight Phrase Cards. Garrard Publishing Co., Champaign, Illinois, 1948.

Language Arts

Boning, R. Supportive Reading Skills: Reading Homonyms, Syllabication, Learning to Alphabetize, Using Guide Words. Dexter and Westbrook, Ltd., Baldwin, New York, 1974.

Newburg, J. and Van Natta, M. Language Patterns and Usage. The Continental Press, Elizabethtown, Pennsylvania, 1969.

Instructo Learning Centers. Homonyms, Alphabetical Order, Learning When to Capitalize, The Caveman Plurals Center, Contractions Magic Show. Instructo Coporation, Paoli, Penn., 1974.

(Appendix A continued)

Reading Games

Sea of Vowels, Ideal School Supply Co., Oak Lawn, Illinois.

Start Your Engines, Ideal School Supply Co., Oak Lawn, Illinois.

Tufabet, Avalon Hill Company, Baltimore, Maryland.

Word-Picture Dominoes Phonics, Developmental Learning Materials, Niles, Illinois.

Word-Picture Dominoes Sight Words, Developmental Learning Materials, Niles, Illinois.

Appendix B

List of Materials Used in Attention Control Group

Mathematics

Mathematics Around Us: Skills and Applications, Grades K-8. Scott, Foresman and Company, Oakland, New Jersey, 1975.

Moving up in Time. Developmental Learning Materials, Niles, Illinois, 1974.

Datasquare^2 Multiplication and Division Tables. Playco Inc., Chester, New Jersey.

Kunz, J. Modern Mathematics Made Meaningful with Cuisenaire Rods. Cuisenaire Co. of America, New Rochelle, New York, 1970.

Ebbert, G. SAM (Science and Math Lab). Selective Educational Equipment, Inc., Newton, Mass., 1973.

Gladstone,D. and Gladstone, J. Mathematics Involvement Program, Grades K-6. Science Research Associates, Chicago, Illinois, 1971.

Games

TUF, Avalon Hill Co., Baltimore, Maryland.

Pay the Cashier, Garrard Publishing Company, Champaign, Illinois.

From Milton Bradley, Springfield, Massachusetts:

Mathfacts Games (Addition and Subtraction)

Mathfacts Games (Multiplication and Division)

Quizmo (Addition and Subtraction)

Count Your Change Game

Fractions are Easy as Pie

Math Learning Centers from Instructo Corporation, Paoli, Pennsylvania:

Telling Time

Addition Facts Zoo

Subtraction Facts Farm

Learning How to Multiply

(Appendix B continued)

Multiplication Facts

Dive into Division

Dig into Fractions

Place Value Fire Fighters

Shopping With Money

Science

Ebbert, G. SAM (Science and Math Lab). Selective Educational Equipment, Inc., Newton, Mass., 1973.

From Selective Eduational Equipment, Inc., Newton, Massachusetts:

Rocks and Charts

Brine Shrimp

Mystery Powders

Seeds and Planting Materials

Social Studies

Concepts and Inquiry: The Educational Research Council Social Science Program Learner-verified Edition II,Grades One through Six. Allyn and Bacon International Division, Rockleigh, New Jersey, 1974, 1975.

Map Skills for Today. Xerox Educational Publications, Xerox Education Center, Columbus, Ohio, 1971.

Table and Graph Skills. Xerox Educational Publications, Xerox Education Center, Columbus, Ohio, 1968.

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Arnold, L.E., Barneby, N., McManus, J., Smeltzer, D.J., Conrad, A., Winer, G., and Desgranges, L. (1977) Prevention by specific perceptual remediation for vulnerable first-graders. Arch. Gen. Psychiatry, 34, 1279-1294.

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Camp, B.W. and Van Doorninck, W.J. (1971) Assessment of "motivated" reading therapy with elementary school children. Behav. Therapy, 2, 214-222.

Cashdan, A. and Pumfrey, P.D. (1973) Some effects of the remedial teaching of reading. In J.F. Reid (Ed.), Reading problems and practices. Ward Loch Educational, London. Pp. 321-327.

Collette-Harris, M. and Minke, K.A. (1978) A behavioral experimental analysis of dyslexia. Behav. Res. Ther. 16, 291-295.

Conners, C.K. (1970) Symptom patterns in hyperkinetic, neurotic and normal children. Child Dev. 41, 667-682.

Conners, C.K. (1969) A teacher rating scale for use in drug studies with children. Am. J. Psychiatry, 126, 152-156.

Daniels, J.C. and Diack, H. (1973) The Standard Reading Tests. Chatto & Windus, London.

Douglas, V.I. and Peters, K.G. (1980) Toward a clearer definition of the attentional deficit of hyperactive children. In G.A. Hale and M. Lewis (Ed.), Attention and the development of cognitive skills. Plenum Press, New York. Pp. 174-247.

Gittelman, R. (1978) Data do not always speak for themselves. Arch. Gen. Psychiatry, 35, 1394-1395. (Letter).

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Gittelman, R., Klein, D.F., and Feingold, I. (submitted for publication) Children with reading disorders: II. Effects of methylphenidate in combination with reading instruction.

Gray, W.S. (1963) Gray Oral Reading Test. Bobbs Merrill Co., Indianapolis.

Jastak, J. and Jastak, S. (1965) The Wide Range Achievement Test. Guidance Associates, Wilmington, Delaware.

Lahey, B.B. Behavior modification with learning disabilities and related problems. In M. Hersen, R.M. Eisler, and P.M. Miller (Eds.), Progress in Behavior Modification. Academic Press, New York. Pp. 173-205.

Madden, R., Gardner, E.F., Rudman, H.C., Karlsen, B. and Merwin, J. (1972) Stanford Achievement Test. Harcourt, Brace Jovanovich, New York.

Monroe, M. (1932) Children who cannot read. University of Chicago Press, Chicago.

Pollack, C. (1969, unpublished) Intersensory Reading Test.

Pollack, C. (1967a) Phonic readiness kit. Book-Lab Inc., Brooklyn, New York.

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